

Metrics for Use in Evaluation of Hospital Respirator Programs



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Abstract

Objective: The respirator is used in the hospital setting as a component of the master occupational infection prevention and control programs that protect healthcare personnel from workplace hazards. These multi-tiered programs address the hazards at all levels through administrative policies, engineering controls and PPE. This study asks what information to gather: (1) to monitor respirator use in hospitals as part of a national pandemic response, and (2) from a broader perspective, to create a foundation for PPE systems research for the purpose of informing policy, certification, and standard setting. **Methods:** To provide the context for data recommendations hospital respirator surveillance activities were superimposed upon patient care and healthcare personnel workflow. Data was identified from associated systems. Metrics were then created from the data that were representative of selection, availability, training, fitting, use, disease outcomes, and confounding factors. Recommendations for the surveillance metrics most representative of respirator programming are made based upon data quality, availability, and representativeness. **Results:** The sample data set recommended as a starting point for national surveillance of hospital respirator use is presented. For hospitals, metrics to serve as a foundation of a surveillance system are recommended that would answer questions regarding agents, respirators, healthcare personnel, organizational factors and work tasks. **Conclusion:** A national system of respirator surveillance capable of monitoring respirator utilization should be created with the capability monitoring respirator activities and confounders necessary to evaluate respirator program effectiveness and therefore inform policy.

Background

In the event of an influenza pandemic, bioterrorism event or novel infectious disease threat, the CDC must make recommendations regarding the use of personal protective equipment (PPE) for healthcare workers (HCW)^[1]. The CDC needs the ability to collect real-time data related to PPE use, availability and effectiveness in the clinical setting.

The respirator is used in the hospital setting as a component of the master occupational infection prevention and control program that protects healthcare personnel from workplace hazards. In this study^[2], Vanderbilt's Health and Wellness Department modeled respirator use in the hospital and identified the data fields that would be best for collection by the NIOSH PPE Surveillance System. The report analyzed the respirator's use in the hospital system and recommended the metrics needed to monitor that system.

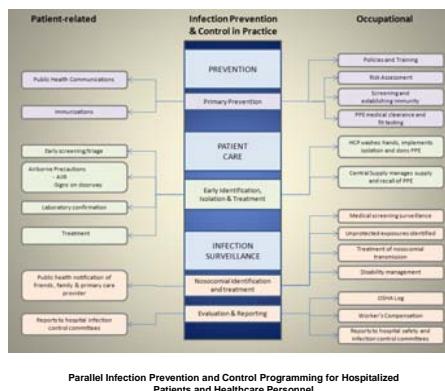
Methods

Metric Determination

1. Vanderbilt databases were reviewed to determine the types of data collected from the Respiratory Infection Prevention & Control Program.
2. A model was developed of hospital respirator surveillance activities that occurred during the workflow of interactions between patients and healthcare personnel in the hospital setting.
3. Data was identified from associated systems.
4. Metrics were created from that data that were representative of selection, availability, training, fitting, use, disease outcomes and confounding factors.
5. Recommended metrics are representative of the entire system of respirator health and safety programs, and are chosen for data quality, availability and representativeness.

Results

Occupational infection prevention and control programs are layered within 3 tiers of healthcare operations: primary preventive services that occur prior to patient care; patient care; and infection surveillance .



The following metrics serve as a foundation of a PPE surveillance system:

Recommended Metrics to Monitor Hospital Respiratory Infection Prevention and Control Programs	
Metric	Vanderbilt Results (2010)
1. How many cases of infectious pathogens were diagnosed at your hospital in the last year?	Reportable Tuberculosis Cases : 8 cases of patients with tuberculosis
2. Does your hospital use the NEDSS and NSHN electronic databases to report reportable infectious diseases, hospital acquired infections and/or blood and body fluid occurrences?	Infection Control reports to TN Dept of Health, which uses NEDSS; Infection Control enters data directly into the NSHN database
Respirator Specific	
3. How many HCP are fit tested/hospital bed day/year?	(7,497 / 272,731) x 100 = 3%
4. What percent of HCP in the respirator program are prepared to use the respirator as of a specific date and how many more are eligible?	66.7% fit tested within past year (5001/7497) 87.2% fit tested ever (6536/7497)
5. What are the make, model, size and brand of respirators selected for use at your hospital?	Sperian Small: 75.6% Sperian Medium: 16.7% 3M Small: 6.3% Sperian Large: 0.8% All Other: 0.8%
6. How many respirators per hospital bed day were ordered by your hospital in a given time period?	(32,648 / 272,731) x 100 = 12%
7. Does your hospital subscribe to a recall system that includes respirators?	Yes - RASMAS
Healthcare Personnel Specific	
8. What percent of HCP know the make (brand) and size of respirator for which they were last fit tested?	211 / 348 (60%) HCP correctly identified the brand of N95 respirator for which they were last fit tested; 204 / 348 (57%) HCP correctly identified the size of N95 respirator last fit tested
9. What problems do HCP give for not wearing the respirator for which they were last fit tested?	No problems: 47% Difficult to breathe: 24% Uncomfortably warm: 24% Difficult to understand: 14% Obstructive feelings: 13% Interferes with other PPE, such as face shield: 12% Interferes with eyeglasses: 2% Facial hair: 2%
10. How many unprotected exposure events occurred related to airborne illness at your hospital in a given time period?	6 events of unprotected exposure to airborne illness
11. How many TB conversions occurred at your hospital in a given time period?	#TB skin test conversions from annual surveillance of TB skin tests: 40 #TB skin test conversions with a known VU source patient: 1 #TB skin test conversions with an unknown patient contact: 6 #TB skin test conversions with patient contact, source not known: 33 #TB with active TB related disease: 0
12. What is the total number of respiratory conditions that are listed in column M(3) of the OSHA 300 Log?	3 records of respiratory conditions on column M(3)
Organizational/Environmental Specific	
13. Do you have a written plan to comply with OSHA 1910.134?	Yes
14. Is compliance with respirator fit testing part of annual performance review or credentialing?	Yes
15. How many AllRs/hospital bed do you have?	72 AllRs at VUMC
16. Does your hospital have a stockpile of respirators in reserve? How many N95 respirators are in the hospital stockpile?	Yes, Vanderbilt has a stockpile: 153,800 N95 respirators
17. How many HCP in the respirator program were immunized against influenza in a given period?	7,496 HCP immunized in FY 2010
18. Data quality: Does your hospital collect electronically the requirements of OSHA reporting outlined in the respiratory standard? (employee id, type of fit test, make/model/style of respirator, date of test and pass/fail results)	Yes
Work Task Specific	
19. What are hand hygiene rates at your hospital?	VUH (adult hospital): 85% VCH (children's hospital): 80% VPH (pediatric hospital): 94% VMG (outpatient medical group): 94% Occupational Health Clinic: 93%
20. What is the average time from admission to laboratory confirmation of airborne disease in your hospital?	0.8 days
21. What is the number of airborne isolation orders/admissions/time interval at your hospital?	365 airborne isolation orders entered into the EMR in 1 year
22. How many airborne isolation orders written on distinct patients/bed day in a given time period?	328 unique patients with airborne isolation orders in 1 year

Conclusion

There are metrics that would reflect respirator use and effectiveness in the hospital setting. These metrics could be used to inform the data collection of a national PPE surveillance system.

Discussion

Identifying data that represents respirator use and effectiveness is the first step in the development of a surveillance system. Collecting and analyzing the data, then acting on the information and disseminating it are part of a public health response. Having reviewed how respirator surveillance occurs in the hospital setting, the challenge is to determine how to accomplish respirator surveillance on a national scale for the purposes of a disaster preparedness response and ongoing evaluation.

When considering the construction of a National PPE Surveillance System, it is necessary to make distinctions about the type of data that could be collected. It would be simplest to collect counts of various factors related to PPE, such as number of masks, number of fit tests or number of employees trained. However, to understand the effectiveness of the system that promotes and supports a hospital respirator program, it is better to have measures that capture the context of the system in which PPE measures are embedded. The ability of the respirator to protect healthcare workers is affected by the properties of the hazard, the type of work performed, organizational culture, the availability of appropriate environmental controls, and the knowledge/attitudes/beliefs of the healthcare worker.

References

1. Murray, M., et al., *Facial protective equipment, personal, and pandemic: impact of the pandemic (H1N1) 2009 virus on personnel and use of facial protective equipment*. *Infect Control Hosp Epidemiol*. 2010; 31(10): p. 1011-6.
2. Yarbrough, M., *A Demonstration and Sentinel PPE Surveillance System in U.S. Healthcare Personnel*, in *NIOSH (National Institute for Occupational Health) 2011: (unpublished)*.